

Dr. Marianne Guerin - Associate, Resource Management Associates**WaterFix Role: Water Temperature Modeling using DSM2-QUAL**

Years' Modeling Experience: Total: 24, with RMA: 10+

Education:

PhD, Mathematics, University of Maryland at College Park, Maryland, 1994

BA, Mathematics, Humboldt State University, California, 1985 (*Summa Cum Laude*)

Qualification Highlights:

- Expertise in the application of both the DSM2 and RMA models of the Sacramento-San Joaquin Delta for hydrodynamics, aqueous transport modeling including water temperature and nutrients, and particle tracking applications.
- From 2008 through 2016, solely responsible for:
 - Successive calibration and validation updates of the DSM2-QUAL temperature and nutrient models (QUAL Version 6 and Version 8).
 - Application of the DSM2-QUAL water temperature module and the nutrient module
- Involved in numerical modeling tasks for California WaterFix and Bay Delta Conservation Plan since inception:
 - Responsible for water temperature modeling for Bay Delta Conservation Plan using DSM2 (2015)
 - Responsible for nutrient modeling for Bay Delta Conservation Plan using DSM2 (2014)
 - Responsible for Project Management for Water Clarity Appendix C for Bay Delta Conservation Plan (2012).

Water Fix Modeling Qualifications Statement: Modeling water temperature and other constituents in the Delta using DSM2-QUAL

Dr. Guerin has been developing and applying numerical models in hydrodynamics, water quality, and aqueous transport phenomena including water temperature, nutrients and pollutants for over 24 years. She has worked extensively on Bay-Delta issues including the Pelagic Organism Decline, most recently focusing on modeling water temperature and nutrient dynamics using DSM2-QUAL. In particular, Dr. Guerin spearheaded the work to update the calibration and validation of DSM2-QUAL water temperature and nutrient modules (Version 6 and separately for Version 8), as well as implementing a major extension to the model with the addition of effluent sources in the Delta. She has expertise in applying both the RMA Delta Model and DWR DSM2 for hydrodynamics, water quality including water temperature and nutrients, and for particle tracking simulations. She has extensive knowledge of Delta operations, hydrodynamics and transport phenomena gained through work on CALSIM-scenario based DSM2 modeling for multiple proposed projects in the Delta. As a member of several collaborative modeling and analysis teams, she was involved with Bay Delta Conservation Plan

and WaterFix using DSM2 for modeling water temperature and nutrients, and using a combination of numerical models including RMA and DSM2 model applications for assessing sediment transport, turbidity and water clarity for Appendix C of the Bay Delta Conservation Plan.

Relevant Transport Modeling Projects

Transport Modeling for Water Temperature and Nutrients; Water Clarity and Sediment Analyses

RMA Technical Lead: DSM2 Water Temperature Modeling in Support of California WaterFix. ICF; Sacramento-San Joaquin Delta, CA Utilized DSM2-QUAL to evaluate the effects on Delta water temperature regime to changes in selected operational regime changes and altered bathymetry of the Sacramento and San Joaquin Delta and to changes from sea level rise and from climate change. Hydrodynamic scenarios were based on CALSIM model output. Developed synthetic meteorological and inflow water temperature boundary conditions for WaterFix scenarios based on simulations 1921-2003, ran simulations and analyzed model output.

RMA Technical Lead: DSM2 Water Temperature Modeling in Support of the Bay-Delta Conservation Plan. DWR and ICF; Sacramento-San Joaquin Delta, CA Utilized DSM2 to evaluate the effects on Delta water temperature regime to changes in selected operational regime changes and altered bathymetry of the Sacramento and San Joaquin Delta and to changes from sea level rise and from climate change. Hydrodynamic scenarios were based on CALSIM model output. Compared water temperature simulation results from DSM2-QUAL and the RMA11 two dimensional representation of the area in and around Liberty Island for selected historical periods.

Project Manager and RMA Technical Lead; DSM2 Water Quality Model Calibration and Validation. State Water Contractors; Sacramento-San Joaquin Delta, CA. Responsible for a major extension of the DSM2-QUAL (Version 6) application for modeling water temperature and nutrient dynamics for the historical period 1990 – 2008. The extension included inflow and transport model constituent inputs from all major waste water effluent sources within the Delta. The project included extensive calibration and verification for water temperature and nutrients, as well as an additional calibration/validation project for QUAL Version 8.

RMA Technical Lead; BDCP Temperature and Nutrient Model Recalibration and Scenario Analysis; ICF and SAIC; Sacramento-San Joaquin Delta, CA. Developed and analyzed DSM2 simulations of Bay Delta Conservation Plan scenarios modeling changes to Delta water temperature and nutrient dynamics due to climate change, sea level rise, Delta bathymetry changes and proposed project operations. Performed data analysis using sediment data and DSM2-HYDRO model output from selected Bay Delta Conservation Plan scenarios to assess potential sediment loads to the Delta from upstream sources.

RMA Project Manager; BDCP Water Clarity Appendix C; ICF; Sacramento-San Joaquin Delta, CA. Responsible for managing and contributing to the analysis of water clarity changes

to a selected Bay Delta Conservation Plan project scenario in comparison with the No Project scenario. Some of the mechanisms addressed included sediment sources and seasonal timing, tidal transport, and wind-wave resuspension. Newly opened restoration areas were considered. Models included RMA11, RMATRK particle tracking model applications and DSM2.

RMA Technical Lead; DSM2 Nutrient Modeling in Support of California's Drinking Water Policy; CUWA (California Urban Water Agencies); Sacramento-San Joaquin Delta, CA.

Utilized DSM2 to evaluate the effects of changes in the Sacramento and San Joaquin River watersheds on water quality (water temperature, organic carbon, nutrients, salinity and bromide) at Delta drinking water intakes. Worked closely with Systech Engineering, Inc. to use WARMF model water quality output at river inflow boundaries in DSM2 scenarios.

Other DSM2 and/or RMA Hydrodynamics and Transport Modeling Projects

RMA Technical Lead on Multiple DSM2 Projects: DSM2 Hydrodynamic and Water Quality Modeling for Projects in the Sacramento-San Joaquin Delta, CA.

For each the following Projects, the goal was to develop DSM2 models using CALSIM scenario output for Project Alternatives and perform alternatives analysis using DSM2 model output. These projects typically require development and comparative analysis of project alternatives for flow, stage and salinity. Some projects additionally specify analysis for bromide load at export locations, volumetric analysis to determine water sources at in-Delta locations, or water velocity analysis to determine the potential levee degradation.

CDM Smith: San Joaquin River Restoration Program EIS/EIR

CDM Smith: San Luis Low Point Improvement Project (SLLPIP) EIS/EIR

CDM Smith: Municipal and Industrial Water Shortage Policy EIS

CDM Smith: Long-Term Water Transfer Program EIS/EIR

San Luis and Delta Mendota Water Authority: Old-and-Middle River Flow Analysis – Comparison of CDEC/USGS and Hutton/MWD Indices Using DSM2

Delta Wetlands Project: DSM2 Stage, Velocity and Water Quality Modeling and Analysis

Sr. Water Resources Specialist; Delta RMP Nutrients Subcommittee; San Francisco Estuary Institute/Aquatic Science Center. Dr. Guerin worked with SFEI staff providing particle tracking modeling and analysis to the Delta Regional Monitoring Program nutrients subcommittee to identify monitoring options for areas or habitat types that are currently under sampled.

Sr. Water Resources Specialist; Delta Modeling Science Workgroup; San Francisco Estuary Institute/Aquatic Science Center. Dr. Guerin worked with SFEI staff providing modeling analysis to the Delta Regional Monitoring Program workgroup to help evaluate the current nutrient monitoring network and identify cost effective monitoring options for areas or habitat types that are currently under sampled.

Project Manager; Delta Modeling Science Workgroup; Hydraulic Modeling Services to Support Sacramento River Research; Sacramento Regional County Sanitation District.

RMA staff are working with Regional San scientists to develop and use numerical hydrologic models representing the time periods of sampling experiments taking place on the upper Sacramento River through the northern Delta. Analyses included the use of in-situ water temperature and salinity measurement as an aid in RMA model calibration.

Co-Project Investigator; Modeling nutrient transformations and losses in the Sacramento/San Joaquin Delta; IEP (Interagency Ecological Program).

Responsible for the modeling portion of this multi-disciplinary project taking a long-term view of the fate and transformations of nutrients in the Delta. Co-PI's are at USGS and SFEI.

Co-Project Investigator; FLaSH project; IEP (Interagency Ecological Program).

Responsible for the hydrodynamic modeling, including residence time analysis, of this multi-disciplinary project investigating nutrient transformations along the Sacramento River and in the Cache Slough-Yolo Bypass-Liberty Island region in recent fall seasons.

Sr. Water Resources Specialist; RMA Forecast Modeling for the USGS/IEP Lagrangian Experiments.

Worked closely with USGS researchers, produced forecast models using RMA2/RMA11 and RMATRK particle tracking applications to track the progression of waters with and without effluent from the Sac Regional wastewater outfall location. The USGS/IEP "Lagrangian" experiments covered two seasons of hydrologic conditions in 2013 and 2014.

Sr. Water Resources Specialist; Real-time Turbidity Forecasting and Development; Metropolitan Water District; Sacramento-San Joaquin Delta, CA.

Responsible for development of turbidity forecasting methodology using the RMA11 two-dimensional turbidity transport model of the Delta. Calibrated the RMA11 turbidity model. Worked closely with DWR staff to incorporate DSM2 hydrodynamics and salinity forecasts and WARMF model turbidity forecasts (Systech Engineering, Inc.) into RMA models for weekly forecasts of hydrodynamics, salinity and turbidity in the Delta. Forecast results were implemented in the RMA delta smelt particle tracking model to predict the location of adult smelt during high turbidity events.